Institut für Höhere Studien (IHS), Wien
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Inefficiency and Social Exclusion in a Coalition Formation Game

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Abstract

This paper reports the results of experiments involving a 3-person coalition formation game with an ultimatum bargaining character. The grand coalition was always the efficient coalition decision, whereas the values of the 2-person coalitions are varied such that they lead to an efficiency loss in the range of 6.7 up to 30 percent. Furthermore, the 2-person coalition implies social exclusion, since the not chosen member always receives a payoff of zero. Consistent with results reported in the literature on 2-person ultimatum bargaining experiments, negative reciprocity (i.e. punishment of unfair offers) plays a crucial role in decision making. The hypothesis that selfishness and anticipated negative reciprocity by proposers together with actual negative reciprocal behavior of responders lead to inefficient outcomes and social exclusion is strongly supported by the data. It turns out that a huge majority of proposers choose the inefficient and unfair 2-person coalition. Proposer-induced efficiency losses vary between 5 and 20 percent, and one sixth to almost one third of the population is excluded from participation.

Keywords

Coalition formation, inefficiency, reciprocity, social exclusion

JEL Classifications

A13, C91, D61, D63

Comments

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Instructions and data set are available upon request.

Contents

1 Introduction

Efficiency and equity are major themes in economics. Almost all of scientific research centers on one or both of them. Consequently, lots of scientific efforts have been put into research about how to design institutions that lead to efficient and equitable allocations of scarce resources. Theoretical models of economic design are based on the assumption of rationality and selfishness of agents. However, based on a number of experimental studies there is now little doubt that behavior of most people is not solely guided by selfishness. In particular, reciprocal behavior has been shown to be an important and stable regularity under different institutional arrangements. The neglect of reciprocal motives in the standard approaches dealing with questions of efficiency and equity may lead to wrong predictions, and therefore to wrong normative conclusions. We argue that reciprocal motives can lead to inefficient allocations where standard theory predicts efficiency. Furthermore, they lead also to very unequal distributions of income due to social exclusion of some members of a group.

Reciprocal motives can be divided into two types. First, positive reciprocity is the desire to reward kind behavior with kindness. Studies on gift exchange and trust-games by, e.g., Fehr, Kirchsteiger, and Riedl (1993, 1998) and Berg, Dickhaut, and McCabe (1995) have shown that generous behavior often triggers reciprocal responses. Receivers of a gift respond by being generous to the sender of the gift, although this behavior is not in their monetary self-interest. Senders anticipate this kind of reciprocal behavior and therefore actually send a gift, which would not be in their self-interest if they expect the receivers to be rational in the standard sense. Fehr, Gächter, and Kirchsteiger (1997) present experimental evidence showing that the presence of reciprocal forces can lead to an increase of the set of enforceable contracts in a principal agent setting. They show that if parties have the possibility to reciprocate this leads to non-negligible efficiency gains. Furthermore, they also observe more equal outcomes than predicted by standard theory based on the assumption of selfish income maximizers. They find the strongest effects if subjects have not only the opportunity to reward kind behavior but also if they can punish behavior they perceive as unfair. The latter is also called negative reciprocity, the second type of reciprocal behavior.

Observations of negative reciprocity mainly come from the huge body of experiments on ultimatum games, initiated by the seminal paper of Güth, Schmittberger, and Schwarze (1982). In ultimatum games subjects are willing to forgo money income in order to punish proposers who made unfair offers. Subjects who move first seem to anticipate this behavior and make offers which are only slight deviations from the equal split (for an overview on experimental evidence in ultimatum games see, e.g., Roth (1995), and Camerer and Thaler (1995)). The studies by Roth, Prasnikar, Okuno-Fujiwara, and Zamir (1991), Prasnikar and Roth (1992), and Güth and van Damme (1998) support the hypothesis that "fair" proposals are not motivated by intrinsic fairness, but by the anticipation of punishment of too greedy demands. Hence, proposers seem to act selfishly under the constraint of negative reciprocal responses by responders. In ultimatum games the presence of negative reciprocity not only leads to more equal outcomes than predicted by game theory, but also to inefficiencies due to the rejection of positive offers. In principle, however, these inefficiencies can be overcome when proposers exactly know the responders' threshold value.

We argue that under reasonable institutional conditions the presence of negative reciprocity leads necessarily to *inefficient outcomes* and *social exclusion*, which can not be overcome by complete information conditions. To test this hypothesis we implemented four experimental conditions within two treatments. Each treatment consisted of two phases. In each phase within a treatment proposers had to choose between a 3- and a 2-person coalition. Since we implemented strongly super-additive games, the 3-person coalition was always the only efficient coalition decision. Thereafter, proposers had to make a proposal how to divide the value of the coalition between herself and the chosen responder(s). Only if all chosen responders accepted the proposed allocation was implemented. Otherwise everybody earned nothing. The responder who was not chosen was excluded from the bargaining game and earned nothing irrespective of the behavior of the other group members. Hence, whenever a proposer opted for a 2-person coalition she actively decided for an inefficient allocation and the exclusion of one of the potential partners. The four experimental conditions only varied in the value of the 2-person coalition. In phase one of our first treatment (which we will abbreviate by T1-2800) the value of the 2-person coalition was 93.3% of the value of the 3-person coalition. In the second phase of treatment one (T1-1200) it was only 40% of the value of the 3-person coalition. In the second treatment the values of the 2-person coalitions were 70% in phase one (T2-2100) and 83.3% in phase two (T2-2500).

The results of all conditions strongly indicate that proposers' behavior has been guided by selfish money maximization and by anticipated negative reciprocity. The expectation of proposers that unfair offers will be punished by rejection was confirmed by responders' behavior. We observe that in T1-2800 and T2-2500 a huge majority (up to 91%) of proposers opt for the 2-person coalition. They thereby exclude almost one third of the population from participation and leave them with a payoff of zero. In addition, this leads to efficiency losses in the range of 5 up to 15 percent. In T2-2100 still about half the proposers choose the inefficient and unfair 2-person coalition. This implies that about one sixth of the population is excluded. The actual efficiency loss in this condition lies between 13 and 20 percent. Only in T1-1200 do we observe no social exclusion and no inefficient coalition decisions.

Proposers' as well as responders' bargaining behavior within 2- and 3-person coalitions is very much in line with regularities known from 2-person ultimatum games. In both coalitions responders punish unfair offers by rejection and the probability that an offer is accepted increases with the size of the offer. In 2-person coalitions proposers average offers are around 40% of the value of the coalition, with slight differences across conditions. Within 3-person coalitions, proposers offer on average each of the two responders about 30% of the value of the coalition. The disagreement rates in 3-person encounters are slightly higher than in 2-person bargaining. Furthermore, proposers exhibit no preference for one of the two responders, neither when they choose only one responder as the bargaining partner in the 2-person coalition nor when making offers in the 3-person coalition.

In summary, the data suggest that *proposers behave selfishly and anticipate negative reciprocity. They therefore rather choose an inefficient and unfair allocation which gives them a higher (expected) payoff than an efficient and fairer allocation. The expectation of negative reciprocity is confirmed by responder behavior. Together these regularities lead to inefficient allocations and social exclusion.*

The rest of the paper is organized as follows: In the next section we present the game we have implemented in the laboratory in more detail. We also discuss the standard game theoretic prediction and possible implications of reciprocity, fairness, and a preference for efficient outcomes. In section 3 we present the experimental setup. Section 4 presents and discusses the regularities in the data. The final section summarizes and concludes.

2 The Game and Behavioral Hypotheses

2.1 A 3-Person Ultimatum Game with a Coalition Decision

Here we describe briefly the rules of the game played by our subjects. It is a 3-person ultimatum game that is extended by a coalition decision made by the proposer. The sequence of the play is the following (see also figure 1):

1. The *proposer* P decides which coalition she wants to choose. She has the choice between a 2-person (small) and the 3-person (grand) coalition. The grand coalition has a value of $V(P, R1, R2)$, where $R1$ and $R2$ stands for *responder 1* and *responder 2*, respectively. The value of the 2-person coalition, denoted $V(P, Ri)$, is strictly smaller than the value of the grand coalition.
2. After P has made her coalition, decision she has to make a proposal how to divide the value of the coalition between her and the *chosen* bargaining partner(s).
   (a) If she has chosen the grand coalition, she has to make a proposal (x_P, x_{R1}, x_{R2}) with $x_P + x_{R1} + x_{R2} \leq V(P, R1, R2)$ to both responders.
   (b) If she has opted for a 2-person coalition, she has to make a proposal (x_P, x_{Ri}) with $x_P + x_{Ri} \leq V(P, Ri)$ only to the chosen responder Ri.
3. If $R1$ has been chosen as a member of either the grand or the small coalition, he has to decide whether to accept or to reject the proposal. If he has not been chosen, he has nothing to decide on.
4. For $R2$ the same holds as for $R1$.

Figure 1:

The payoffs are allocated as follows: (i) If P has chosen the grand coalition and *both* responders *accept* the proposal then all players receive their shares according to the proposal. If either one or both players *reject* the proposal nobody earns anything. (ii) If P has opted for a 2-person coalition and *the chosen* responder *accepts* the proposal then these two players receive their shares according to the proposal. If he *rejects* the proposal both earn nothing. The responder who has not been chosen always earns nothing (independent of the proposal made and the response by the other responder).

All this information is known to all players, and all players are informed about the decision of the other players. Hence, it is a game of perfect and complete information. By working backwards, it can be easily seen that this game has a unique subgame perfect equilibrium (payoff). Consider first the case where P has chosen the 3-person coalition and has made some proposal (x_P, x_{R1}, x_{R2}). Consider $R2$ now and assume that $R1$ has rejected the proposal made by the proposer. In that case, the second responder is indifferent between accepting and rejecting, because in any case he will get nothing. Now suppose that the first responder has accepted the proposal made by P. Then $R2$ will also accept as long as his share is nonnegative, i.e., as long as $x_{R2} \geq 0$. $R1$ will also accept the proposal as long as his share is at least zero ($x_{R1} \geq 0$).[1] Given this behavior of responders the best the proposer can do is to demand the whole pie $V(P, R1, R2)$ for herself and offer 0 to both responders. Hence, in the subgame starting after the proposer has opted for a 3-person coalition exists a unique subgame perfect equilibrium where P demands the whole pie for herself and both responders accept.[2] Now assume that P has chosen the 2-person coalition with Ri ($i = 1, 2$) as her bargaining partner. Since P and Ri are playing an ultimatum game the unique subgame perfect equilibrium implies that the proposer demands the whole pie $V(P, Ri)$ for herself, leaving Ri a payoff of zero which he will accept. Since the value of the 2-person coalition is strictly smaller than the value of the 3-person coalition, the unique best response for the proposer is to opt for the 3-person coalition. Hence, game theory predicts that P chooses the 3-person coalition and makes the proposal $(x_P^*, x_{R1}^*, x_{R2}^*) = (V(P, R1, R2), 0, 0)$ which is accepted by both responders.

[1] After $R1$ has accepted a proposal $R2$ will also accept in equilibrium even if the proposal gives him a payoff of zero. The reason is that if he would not accept all players would get a payoff of zero. The proposer, however, could then change the proposal in a way such that $R2$ gets a slightly positive payoff and is still accepted by $R1$. Such a proposal will surely be accepted by $R2$ giving at least the proposer and the second responder a positive payoff. Hence, rejection of an offer of zero by $R2$ can not be part of a subgame perfect equilibrium. A similar reasoning holds for $R1$ when he receives a proposal which gives him a payoff of zero.

[2] Since $R2$ is indifferent between rejection and acceptance after $R1$ has rejected a proposal, there are two subgame perfect equilibria in pure strategies. Since they are payoff equivalent for convenience, we speak of a unique equilibrium.

2.2 The Implications of Reciprocity, Fairness, and Preference for Efficient Outcomes

Taking the evidence from 2-person ultimatum bargaining experiments into account one can not expect to observe the behavior predicted by the subgame perfect equilibrium. In particular the experiments on 2-person ultimatum games give some hints about possible behavior of subjects in our experiment. The experimental evidence in these games can be summarized as follows: Most of the demands made by proposers lie in the range of 50 to 60 percent of the pie to be allocated, offers below 20 percent are almost always rejected, and the acceptance rates of responders are on average monotonically increasing with the offer made. In particular, these studies show that people are willing to forgo money in order to punish if they feel treated unfairly. Furthermore, the studies by Roth, Prasnikar, Okuno-Fujiwara, and Zamir (1991) and Prasnikar and Roth (1992) show that – given the observed acceptance behavior of responders – a proposer's payoff is maximized at offers in the range between 40 and 50 percent. They also show that – at least when subjects are experienced – proposers anticipate this and make mostly offers that fall into this range. Hence, proposers seem to act in a selfish manner taking into account the possibility of negative reciprocal behavior of responders. This view is also supported by the observations made by Güth and van Damme (1998). They report results from a 3-person ultimatum game that is the most similar experiment to ours we know about. In their experiments a proposer had to decide how to divide a pie between her and two bargaining partners. Only one of the two partners had the possibility to reject the proposal whereas the third player was a "dummy". One of their main conclusion is that proposers are neither strongly intrinsically fair nor do they act according to game theory. Proposers, however, realize that the responder with veto power may decline unfair offers.

To what extent would such behavior change the predictions in our experiment? This obviously depends on the relative value of the 2- and the 3-person coalition. Roughly speaking, it means that if the value of the 2-person coalition is not considerably smaller than the value of the 3-person coalition proposers may choose the small coalition. This statement is very loose since the coalition decision also depends on the anticipation of responders' behavior in a 3-person coalition. Until now there is no experimental evidence on responder behavior in 3-person ultimatum games when both responders have veto power. However, a natural focal point in 3-person ultimatum games is the equal division between all three players. Hence, if proposers act selfishly and anticipate that responders reject offers which they interpret as unfair, then proposers should choose the 2-person coalition whenever $1/2 \times V(P, Ri) > 1/3 \times V(P, R1, R2)$. Note that such behavior is neither fair nor does it lead to an efficient outcome. Hence, we would observe *social exclusion* and *inefficiency.* If however $1/2 \times V(P, Ri) < 1/3 \times V(P, R1, R2)$ holds then such subjects should choose the 3-person coalition since they can expect to earn more money than in the case where they choose the 2-person coalition.

On the other hand, if proposers are either intrinsically fair or if they have a strong preference for efficient outcomes, they should always choose the 3-person coalition. This would be in line with the arguments put forward by Güth and Tietz (1990) in a reply to the unfair outcomes observed in "best shot games" (see Harrison and Hirshleifer (1989) and Prasnikar and Roth (1992)). They argue that in "best shot games" fair divisions are always inefficient and that therefore fairness considerations can not be applied. As suggested by the results of Hoffman and Spitzer (1982, 1985) the desire for efficiency seems to be a strong motivation. In our experiment, in contrast to the "best shot games", fair divisions and efficiency go together. Whenever a proposer wants to be fair she has to choose the efficient 3-person coalition because otherwise one of the potential responders will get nothing. Hence, proposers with preferences for fairness will choose the grand coalition and make a proposal which divides the value $V(P, R1, R2)$ (almost) equally.

If proposers have a strong preference for efficient outcomes, they nevertheless may act strategically, given the efficient allocation. If this is the case we should observe 3-person coalitions but proposals giving the proposer considerably more than any of the two responders.

3 Experimental Setup

After some pilot studies we have conducted eight experimental sessions involving 192 subjects. The sessions differed with respect to the location where they took place and with respect to the value of the 2-person coalition (for a summary see table 1). All sessions have been classroom experiments. We ran experiments with two different treatments, which we will call T1 and T2. Both treatments consisted of two phases and had the following features. *Phase 1:* After arriving subjects were randomly divided into "R's", "M's", and "L's". These letters referred to the place in the classroom where they were seated. The "R's" have been the proposers, the "M's" the first responders and the "L's" the second responders. A bargaining group consisted of one "R"-, one "M"-, and one "L"-subject. The room was arranged in such a way that subjects with different letters (i.e., roles) were not able to communicate with each other. The instructions were read aloud, and thereafter the subjects played a practice round (during which they were allowed to ask questions to ensure that everybody has understood how to make decisions).

Thereafter, eight rounds were played, with changing partners after each round.[3] The subjects were told that – in addition to the show up fee – after the experiment they

[3] In two sessions subjects were told that in the last round there is one member of the group with whom they have played in an earlier round. This was necessary because of some no-shows in these two sessions. However, the identification numbers were changed after the seventh round so that they were not able to identify with whom they played twice.

Table 1: Experimental treatments

Treatment		$V(P,R1,R2)$	$V(P,Ri)$	Sessions	# of Subjects
T1	Phase 1	3000	2800	Kyoto I, 06/26/1997	24
				Kyoto II, 07/03/1997	24
				Kyoto III, 07/04/1997	24
	Phase 2	3000	1200	Vienna I, 11/05/1997	24
				Vienna II, 11/12/1997	21
				Vienna III, 11/13/1997	21
T2	Phase 1	3000	2100	Vienna IV, 03/13/1998	24
	Phase 2	3000	2500	Kyoto IV, 06/04/1998	30

will be paid in cash the sum of their earnings in two out of the eight rounds. These two rounds were randomly selected at the end of the experiment. Subjects were informed about that. After the last round of phase 1 the subjects were told that there will be another experiment. This started *Phase 2*. Again, after the instructions were distributed they were read aloud. The participants were told that after the eighth round the experiment will be over for sure and that they will be paid in cash the sum of their earnings in two – randomly chosen – rounds out of the eight rounds. The earnings from the first phase were unaffected by those of the second phase. No practice round took place in this phase. Subjects played again eight rounds. The matching of subjects was the same as in phase 1. Phase 1 and phase 2 only differed in the value of the 2-person coalition. All values have been described in points. The value $V(P,R1,R2)$ of the grand coalition was always 3000 points. The value $V(P,Ri)$ of the 2-person coalition in T1 was 2800 points in phase 1 and 1200 points in phase 2. In T2 the value of the small coalition was 2100 points in phase 1 and 2500 points in phase 2. Therefore, in the following we will write T1-2800, T1-1200, T2-2100, T2-2500 when we refer to the different experimental conditions.

We conducted six sessions with T1 involving 138 subjects. Three of these sessions were run in Kyoto, Japan, at the Institute of Economic Research at Kyoto University, in June and July 1997. The other three sessions were run in November 1997 in Vienna, Austria, at the Institute for Advanced Studies. Subjects in Japan were – with one exception – undergraduate students from various fields. The majority came from Economics, Business Administration, Law, and Political Science. Subjects in Austria were – with two exceptions – undergraduate students of Business Administration. No subject had participated in an experiment before; none of them – with two exceptions – had knowledge about game theory.[4] In addition, two sessions with treatment T2

[4]In Kyoto the remaining subjects came from Agriculture, Engineering, and Literature. In Vienna

were run. One of the sessions took place in Vienna in March 1998 and the other in Kyoto in June 1998. 54 subjects participated in these sessions. In the Vienna experiment all of them were undergraduate students in Business Administration and in the Kyoto experiment 21 out of 30 were undergraduate students (13 in Economics, and the remaining in Law, Liberal Arts, and Science). The remaining nine graduate students came from Engineering and Computer Science.[5] Proposals had to be made in steps of 10 points. The exchange rates from points to money were 1:1 in Japan (i.e., 10 points = 10 Yen) and 10:1 in Austria (i.e., 10 points = 1 ATS). At the time the experiments were conducted 10 YEN were worth approximately 1 ATS. In terms of US-Dollars 10 points were approximately worth 0.09 USD. Hence, the worth of the grand coalition was around 27 USD.

Given the experimental setup and the chosen parameter values we can now restate the four hypotheses concerning proposer behavior discussed informally in section 2.2. The different hypotheses assume equilibrium behavior (i.e., self-interest and no anticipation of negative reciprocity) (EB), intrinsic fairness (IF), (strong) preference for efficient outcomes (PE), and self-interest with anticipation of negative reciprocity (SI&NR).

Hypothesis EB

Proposers choose the grand coalition and demand at least 2980 points for themselves (i.e. $x_P \geq 2980$), regardless of the value of the 2-person coalition.[6]

Hypothesis IF

Proposers choose the grand coalition and make a proposal of the form $(x_p, x_{R1}, x_{R2}) = (1000, 1000, 1000)$, regardless of the value of the 2-person coalition.

Hypothesis PE

Proposers choose the grand coalition but may act selfish in the subgame where they have to make a proposal (i.e. $x_p > 1000$). Both decisions are independent of the value of the 2-person coalition.

Note that for the hypotheses EB, IF, and PE to be true we should not observe any difference in the coalition decisions between the different conditions. Proposers should always choose the 3-person coalition. Hence, concerning the coalition decisions these three hypotheses are observationally equivalent. However, behavior should differ in the subgames where proposers have to make offers. Hypothesis EB requires very mean

one subject was a graduate student in Political Science and one in Economics. In Kyoto as well as in Vienna one subject had some knowledge about game theory.

[5]Not all of these subjects were completely inexperienced with experiments. Nine of the 24 subjects in Vienna had participated in an unrelated experiment before.

[6]In our experiments proposals had to be made in steps of ten points. This discreteness destroys the uniqueness of the subgame perfect equilibrium. It can be shown, however, that in any subgame perfect equilibrium proposers always choose the 3-person coalition and any proposal which gives each responder at least 10 points is accepted.

demands leaving the responders with (in sum) at most 20 points, whereas Hypothesis IF requires an equal division.

Things are different, however, if proposers try to maximize there money income and expect negative reciprocal behavior of responders. In T1-2800 and T2-2500 choosing the 2-person coalition and proposing the equal division gives 1400 and 1250 points, respectively. Both proposals will be accepted almost surely by the chosen responder. Aiming for the same payoffs in a 3-person coalition would mean to offer at least one responder at most 800 points in T1-2800 and at most 870 points in T2-2500. Both offers are less likely to be accepted by responders leading to a lower expected payoff for the proposer. Hence, in this two conditions selfish proposers are expected to choose the inefficient and unfair 2-person coalition. In T1-1200, on contrary, such proposers should choose the 3-person coalition. Proposing the equal division in the 3-person coalition leads almost surely to a payoff of 1000 points. In the 2-person coalition a demand of 1000 points leaves the chosen responder with only 16.7 percent of the pie, which he will reject with a high probability.

In T2-2100 the reasoning is slightly more complicated. In this case the optimal coalition decision of a money maximizing proposer depends heavely on the demand she wants to make and on the expected probability of rejection of a particular offer. Consider the following examples: If the proposer plans to demand 1050 points for herself, then it is most probably best to choose the 2-person coalition. This implies to propose the equal split, which is (almost) surely accepted. In the 3-person coalition at least one of the responders has to be offered less than 980 points. This possibly leads to a higher probability of disagreement, and therefore to a smaller expected payoff. However, if the proposer plans to demand at least 1300 points it may be worthwhile for her to choose the 3-person coalition. Choosing the 2-person coalition and making such a demand implies to offer the chosen responder at most 800 points. By choosing the 3-person coalition the proposer could offer both responders 850 points. This may have a higher chance of being accepted, and may therefore be the better option. Hence, selfish proposers who expect negative reciprocal behavior of responders may be indifferent between the 2- and 3-person coalition. Our fourth hypothesis summarizes the above reasoning.

HYPOTHESIS SI&NR

(i) In T1-2800 and T2-2500 proposers choose the 2-person coalition *and* make demands $x_p > 1400$ and $x_p > 1250$, respectively.
(ii) In T1-1200 proposers choose the 3-person coalition *and* make demands $x_p > 1000$.
(iii) In T2-2100 proposers may be indifferent between the 2- and 3-person coalition. Therefore, the frequency of 2-person coalitions is lower than in T1-2800 and T2-2500, but higher than in T1-1200. In 2-person coalitions proposers make demands $x_p > 1050$, and in 3-person coalitions proposers demand $x_p > 1000$.
(iv) In all treatments in any bargaining subgame the demands (offers) are considerably far away from the prediction by subgame perfection.

If this hypothesis turns out to hold, it has strong social and economic implications. It says that whenever the efficiency loss due to the choice of a small coalition is not too high we will observe inefficient outcomes and social exclusion due to the interaction of selfishness and (anticipated) negative reciprocity.

4 Experimental Results

In this section we present the results of our experiment. We are using the pooled data from Kyoto and Vienna. A more detailed study about possible cross-cultural differences is reported in an accompanying paper (see Okada and Riedl (1999)). It does not reveal any significant behavioral difference of subjects in Kyoto and Vienna. The subjects' average earnings (net of show up fees[7]) in T1 were ATS 304,- in Vienna and YEN 3141,- in Kyoto. In T2 subjects earned on average ATS 300,- in Vienna and YEN 2952,- in Kyoto. All sessions lasted approximately three hours. In the following we first present the observed main regularities concerning the coalition decisions. Thereafter, we analyze the behavior of responders and proposers in the bargaining stage of the game. The section closes with a discussion of the induced inefficiencies.

4.1 Coalition Decisions

Our first result concerns the coalition decisions in the different conditions. The proposers had to choose between the 2-person coalition with a value of 2800, 2500, 2100, or 1200 points, respectively, and the 3-person coalition with a value of 3000 points. Choosing the 2-person coalition means that the proposer decides for an inefficient allocation and leaves one of her bargaining partners with a payoff of zero.

Result 1 *(i) Whenever the value of the 2-person coalition is high ($V(P, Ri) = 2800$ or $V(P, Ri) = 2500$), a huge majority of proposers opts for the 2-person coalition. (ii) If the value of the 2-person coalition is in an intermediate range ($V(P, Ri) = 2100$), still about half of the proposers choose the 2-person coalition. (iii) For a low value of the small coalition ($V(P, Ri) = 1200$) almost all proposers choose almost always the grand coalition.*
Hence, if the value of the 2-person coalition is not too low, inefficient allocations and social exclusion is observed.

To provide evidence for this result we depicted the evolution of coalition decisions in figure 2 (in addition table 2 lists the percentages of chosen 2-person coalitions per round as well as across rounds).

[7]The show up fee was ATS 70,- in Vienna and YEN 1000,- in Kyoto. In Kyoto in addition to that a "transportation fee" of YEN 500,- was paid to subjects from universities other than Kyoto University.

Figure 2:

It is obvious from figure 2 and table 2 that in T1-2800 and T2-2500 in all rounds most proposers did not care about a fair distribution among all three members in the bargaining group. In particular, even in the first round of T1-2800 (which was the very first round of the experiment) 34 out of 46 proposers (73.9%) have chosen the 2-person coalition. In the first round of T1-2500 even 83.3 percent (15 out of 18) opted for the small coalition. Both observations indicate that a huge majority of the proposers is neither influenced by norms of fairness nor by norms of efficiency. Social exclusion takes place right from the beginning. Furthermore, there is no tendency that the number of 2-person coalitions vanishes when the players gain experience. The opposite takes place. In the third round in T1-2800 the frequency of 2-person coalitions increases to 84.8% and remains around 90% in the last three rounds. In T2-2500 the percentage of 2-person coalitions drops from 88.9 in round 2 to 72.2 in round 4, but increases again to almost 90 percent in the last two rounds.

Table 2: Coalition decisions in T1 and T2

	2-Person Coalitions in T1			2-Person Coalitions in T2		
Round	# Observations	T1-2800	T1-1200	# Observations	T2-2100	T2-2500
1	46	73.9%	4.3%	18	66.7%	83.3%
2	46	73.9%	0.0%	18	44.4%	88.9%
3	46	84.8%	0.0%	18	44.4%	88.9%
4	46	84.8%	0.0%	18	44.4%	72.2%
5	46	78.3%	2.2%	18	66.7%	77.8%
6	46	87.0%	4.3%	18	44.4%	83.3%
7	46	91.3%	0.0%	18	50.0%	88.9%
8	46	87.0%	0.0%	18	44.4%	88.9%
All Rounds	368	82.6%	1.4%	144	50.7%	84.0%

A look at the correlation between chosen 2-person coalitions and rounds supports this observation. For T1-2800 the Spearman rank-order correlation coefficient of 2-person coalitions on rounds yields a value of $r_s = 0.87$ (significant at $p < 0.005$, one-tailed test). In T2-2500 the correlation is also positive ($r_s = 0.17$), however not significant. This indicates that in T1-2800 proposers choose the 2-person coalition more often when they gain experience. Already experienced proposers – as in T2-2500 – show no tendency to choose the 2-person coalition less often over rounds.

Furthermore, even if the value of the 2-person coalition is only 2100 points about half of the proposers do not hesitate to exclude one of the responders from bargaining and choose the inefficient coalition. In the first round of T2-2100 two thirds of the proposers (12 out of 18) choose the small coalition. Hence, as in T1-2800, inexperienced subjects tend to exclude one bargaining partner. Contrary to high values of the 2-person coalition the frequency of small coalitions is smaller in later rounds. However, it drops never below 44.4 percent. Therefore, also if $V(P, Ri)$ is only 2100 points, one sixth of the population is excluded from participation in the bargaining (see also figure 2 and table 2).

Only for the very low value of 1200 points of the 2-person coalition (almost) no inefficient choices are observed. In this condition the coalition decisions are dramatically different. The percentage of chosen 2-person coalitions drops from 87 percent in the last round of T1-2800 to 4.3 percent in the first round of T1-1200. Only 2 out of 46 proposers have chosen the small coalition in round one of T1-1200. Over all rounds proposers had to make 368 coalition decisions. In only five cases the 2-person coalition was chosen. It is clear from these figures that the proposers responded with different coalition decisions to high, intermediate, and low values of the 2-person coalition. As a corollary to our first result we can therefore state:

Result 2 *Proposers make significantly different coalition decisions when the value of the 2-person coalition is high, intermediate, or low.*

These observations already falsify hypotheses EB, IF, and PE, because all of them require that the 3-person coalition is always chosen. The prediction of the "Selfishness and Negative Reciprocity Hypothesis" that proposers change their behavior with the value of the 2-person coalition is confirmed. However, it also states that it is the fear of punishment that drives this behavior. To see if this prediction is confirmed responder and proposer behavior in the bargaining subgames is analyzed in the following section.

4.2 Behavior in Subgames after the Coalition Decision

A short summary of the results is that in 2- as well as 3-person coalitions responders behave negatively reciprocally. Lower offers are rejected with a higher probability than higher offers are. Proposers seem to anticipate this and choose mostly offers which maximize their money income. Based on that we also detect that in those treatments where the maximum expected payoff is higher in 2-person coalitions than in 3-person coalitions proposers actually choose the 2-person coalition.

Hence, the behavior of most proposers can be explained by income maximization under the constraint of responders' willingness to punish unfair proposals. The choice of inefficient and unfair coalitions is a consequence of this behavior. These results are next discussed in more detail. Tables 3 and 4 describe responder and proposer behavior for selected subgames.[8]

[8]Due to lack of data no statistics of behavior in 2-person coalitions in T1-1200 and in 3-person subgames in T1-2800 and T2-2500 are presented.

In T1-2800 as well as in T1-1200 we observed two inefficient proposals. All four are excluded from

Table 3: Summary of behavior in 2-person coalitions

	Average Offers to Chosen Responder and Disagreement Rates								
	T1-2800			T2-2100			T2-2500		
Round	# Obs.	% Dis.	Offer (%)	# Obs.	% Dis.	Offer (%)	# Obs.	% Dis.	Offer (%)
1	34	5.9	1200 (42.8)	12	0.0	963 (45.9)	15	6.7	1087 (43.5)
2	34	17.6	1152 (41.2)	8	12.5	913 (43.5)	16	0.0	1107 (44.3)
3	39	12.8	1060 (37.8)	8	12.5	819 (39.0)	16	12.5	1041 (41.6)
4	38	13.2	1053 (37.6)	8	12.5	913 (43.5)	13	7.7	1027 (41.1)
5	36	19.4	1037 (37.0)	12	25.0	857 (40.8)	14	7.1	1044 (41.8)
6	40	15.0	1072 (38.3)	8	0.0	860 (41.0)	15	6.7	1033 (41.3)
7	41	22.0	1048 (37.4)	9	22.2	856 (40.7)	16	0.0	1031 (41.3)
8	40	15.0	1063 (38.0)	8	12.5	813 (38.7)	16	6.3	981 (39.3)
All	302	15.2	1083 (38.7)	73	12.3	878 (41.8)	121	5.8	1044 (41.8)

Similar to previous 2-person ultimatum game results proposers offer on average around 40 percent of the value of the 2-person coalition to the chosen responder. The average shares offered in T1-2800 are slightly smaller than in T2-2100 and T2-2500. The disagreement rates across all rounds vary between 6 and 15 percent (see table 3). In 3-person coalitions proposers offer each of the two responders more or less the same. In most rounds the offers are slightly below 30 percent of the value of the grand coalition. The aggregated disagreement rates over rounds are in T1-1200 and T2-2100 almost the same and with approximately 20 percent higher than in 2-person encounters (see table 4).

Next, we describe the responder behavior in 2- and 3-person coalitions more closely. We start out with the analysis of responder behavior in 2-person coalitions, thereafter we analyze the behavior in 3-person coalitions.

Responder behavior in 2-person coalitions: Figure 3 shows the rates of rejection (in percent) by offer range and condition. Empty squares indicate that no offers in this range have been made and bars with zero height indicate that all offers in this range have been accepted.

the analysis. In T1-2800 the proposals have been $(1300, 1300)$ and $(2000, 700)$ to R2. Both have been accepted. In T1-1200 the proposals were $(1030, 1050, 900)$ and $(1080, 930, 890)$. Both have been rejected by the second responder. They have been made by three different subjects.

Table 4: Summary of behavior in 3-person coalitions

	Average Offers to Responder 1 and Responder 2 and Disagreement Rates							
	T1-1200				T2-2100			
Round	# Obs.	% Dis.	OfferR1 (%)	OfferR2 (%)	# Obs.	% Dis.	OfferR1 (%)	OfferR2 (%)
1	44	22.7	903	898	6	16.7	875	858
			(30.1)	(29.9)			(29.2)	(28.6)
2	45	22.2	892	878	10	20.0	915	910
			(29.7)	(29.3)			(30.5)	(30.3)
3	46	19.6	893	903	10	20.0	885	875
			(29.8)	(30.1)			(29.5)	(29.2)
4	46	17.4	908	892	10	30.0	860	860
			(30.3)	(29.7)			(28.7)	(28.7)
5	45	17.8	894	886	6	0.0	895	890
			(29.8)	(29.5)			(29.8)	(29.7)
6	44	22.7	898	890	10	30.0	850	780
			(29.9)	(29.7)			(28.3)	(26.0)
7	45	22.2	910	892	9	22.2	853	829
			(30.3)	(29.7)			(28.4)	(27.6)
8	46	17.4	896	899	10	20.0	873	883
			(29.9)	(30.0)			(29.1)	(29.4)
All	361	20.2	899	892	71	21.1	875	860
			(30.0)	(29.7)			(29.2)	(28.7)

Table 5: Logit regressions: Responder behavior in 2-person coalitions

	Condition		
Coefficient	T1-2800	T2-2100	T2-2500
Constant	-6.4681^{***}	-9.8834^{**}	-13.3323^{**}
β_{relof}	13.3386^{***}	26.6572^{**}	27.5636^{**}
β_{avacc}	4.9372^{***}	2.5389	6.6343^{***}
		($p = 0.089$)	
Observations	295	65	116
Log Likelihood	-71.074	-16.751	-17.046
Pseudo R^2	0.44	0.36	0.36

Notes: *** $p \leq 0.001$, ** $p \leq 0.01$

Figure 3:

The picture suggests that in all treatments the rejection rates are decreasing with the offer. This impression will be confirmed by more formal analysis. To see whether there also is a statistically significant impact of offers on responder behavior we run the following logit regression for 2-person coalitions in treatments T1-2800, T2-2100, and T2-2500. We are looking at behavior across rounds and in all regressions we use only those offers which gave the responders at most half of the pie (i.e., at most 1400, 1050, 1250 points, in T1-2800, T2-2100, and T2-2500, respectively.):

$$Accept \quad = \quad f(\alpha + \beta_{relof} * relof + \beta_{avacc} * avacc_i), \tag{4.1}$$

where $Accept = 1$ if the offer was accepted and 0 otherwise, $f(x)$ denotes the logit function, and $relof$ is the offer measured relative to the value of the 2-person coalition. The variable $avacc_i$ equals the average number of offers accepted by responder i, excluding the current offer.[9] $\beta_{avacc} > 0$ means that the more often responders accept other offers, the more often they will accept the current offer.

If negative reciprocal behavior is prevalent higher offers should be accepted more often (i.e. $\beta_{relof} > 0$); whereas subgame perfection requires that all positive offers are accepted (i.e. $\beta_{relof} = 0$). Table 5 shows the results of these logit regressions. In all treatments β_{relof} is positive, and the coefficient is also significantly greater than zero ($p \leq 0.001$ in T1-2800, and $p \leq 0.01$ in T2-2100 and T2-2500). This shows that there is a positive relationship between higher offers and the probability of acceptance. Hence, the responders in 2-person coalitions behaved reciprocally in the sense that they punished proposers by rejecting offers they considered as unfair more frequently. The coefficient β_{avacc} also has the expected positive sign ($\beta_{avacc} > 0$ in all treatments; $p \leq 0.001$ in T1-2800 and T2-2500, and $p < 0.1$ in T2-2100).[10]

Responder behavior in 3-person coalitions: Figures 4a and 4b show the rejection rates (in percent) of first and second responders by offer range and condition.

[9] By including this variable into the regression we follow the approach of Slonim and Roth (1998). The idea is to use this variable as a proxy for individual differences in acceptance behavior, since a random as well as a fixed effects model are inappropriate given our data set. For some responders only one observation is available. For those, $avacc_i$ is set equal to the mean of all responders for each treatment: 84.41%, 86.15%, and 93.97% for T1-2800, T2-2100, and T2-2500, respectively.

[10] We have also estimated the model $Accept = f(\alpha + \beta_{relof} * relof + \beta_{avacc} * avacc_i + \beta_{round} * round)$, where $round$ is included to investigate whether there is any monotonic trend in acceptance rates over time. In no condition the coefficient β_{round} is significantly different from zero ($p > 0.23$).

Figure 4:

Both figures show that – as in 2-person coalitions – lower offers are less often accepted than higher offers. In 3-person coalitions an agreement is reached only if both responders accept. This means that whenever the first responder has already rejected an offer, the second responder's choice does not matter any more. We have therefore run the following regressions to investigate the behavior of the first and second responder in conditions T1-1200 and T2-2100.[11] We use again observations across rounds:

$$\begin{aligned} AcceptR1 &= f(\alpha + \beta_{relofR1} * relofR1 + \beta_{avaccR1} * avaccR1_i), \quad (4.2) \\ CondAcceptR2 &= f(\alpha + \beta_{relofR2} * relofR2 + \beta_{avaccR2} * avaccR2_i), \quad (4.3) \end{aligned}$$

where $AcceptR1 = 1$ ($CondAcceptR2 = 1$) if the offer was accepted by the first (second) responder and 0 otherwise, $f(x)$ denotes the logit function, and $relofR1$ ($relofR2$) is the offer made to the first (second) responder measured relative to the value of the grand coalition. The variables $avaccR1_i$ and $avaccR2_i$ have the same interpretation as in the case of the 2-person coalition, except that they are related to the first and second responder, respectively, in the 3-person coalition. For analyzing the second responder's behavior we take only the observations where the first responder has already accepted. Hence, $CondAcceptR2$ measures the probability that an offer is accepted by the second responder conditional on the acceptance of the first responder.

Table 6: Logit regressions: Responders behavior in 3-person coalitions

	Condition			
	T1-1200		T2-2100	
Coefficient	Responder 1	Responder 2	Responder 1	Responder 2
Constant	-14.2979^{***}	-16.4619^{***}	-3.4349^{*}	-12.6977 ($p = 0.056$)
$\beta_{relofR1}$	39.2061^{***}		19.7584^{**}	
$\beta_{avaccR1}$	6.7014^{***}		omitted[a]	
$\beta_{relofR2}$		46.0453^{***}		42.4011^{*}
$\beta_{avaccR2}$		6.8976^{***}		6.0940 ($p = 0.071$)
Observations	361	320	71	62
Log Likelihood	-68.540	-59.718	-22.042	-5.366
Pseudo R^2	0.46	0.43	0.18	0.55

Notes: *** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$.
[a] $\beta_{avaccR1}$ is insignificant ($p = 0.52$); restricted model with $\beta_{avaccR1} = 0$ estimated.

Table 6 shows the results of the logit regressions. Qualitatively they are very similar to the results obtained from the 2-person coalitions. In both conditions $\beta_{relofR1}$ and $\beta_{relofR2}$ are significantly greater than zero ($p \leq 0.001$ for both responders in T1-1200, $p \leq 0.01$ for $R1$ in T2-2100, and $p \leq 0.05$ for $R2$ in T2-2100). Both responders in a 3-person coalition reject lower offers more frequently than higher offers. The coefficients

[11] In T1-2800 and T2-2500 we have to not enough observations and/or variation in the data.

$\beta_{avaccR1}$ and $\beta_{avaccR2}$ have the expected positive sign in T1-1200 ($p \leq 0.001$). In T2-2100 only $\beta_{avaccR2}$ is significantly positive ($p \leq 0.1$). For the first responder in T2-2100 we can not reject the hypothesis that it is zero. Therefore, in table 6 the estimation for the restricted model with $\beta_{avaccR1} = 0$ is shown.[12] Taking the results for 2- and 3-person coalitions together we conclude:

Result 3 *In 2-person coalitions as well as in 3-person coalitions responders behave negatively reciprocally. They punish proposers by rejecting positive but unfair offers.*

Proposer behavior: The above evidence that responders behave reciprocally is rather convincing. It remains to investigate whether this behavior can explain the coalition decisions of proposers. In view of the fact that in T1-2800 and T2-2500 most proposers have chosen the 2-person coalition (see table 2 and figure 2) it is particularly important to know whether these decisions are in line with income maximization.

Result 4 *Proposer income maximization implies the choice of the 2-person coalition whenever the value of the 2-person coalition is high.*

First evidence for this result is given by figure 5. It shows the average earnings of proposers by condition and coalition across rounds. The three leftmost bars depict the average earnings in 2-person coalitions in T1-2800, T2-2500, and T2-2100 (T1-1200 is not shown since we have observed only five 2-person coalitions in this condition).

[12] As for 2-person coalitions we have also tested for a monotonic experience effect by including a variable for rounds. It is never significant.

Figure 5:

Table 7: Proposer's actual and income maximizing offers

		Offer to Ri			Offer to $R1$			Offer to $R2$		
	$maxE\pi$	Mean	Mode	x^*_{Ri}	Mean	Mode	x^*_{R1}	Mean	Mode	x^*_{R2}
2-PC in										
T1-2800	1680	1055	1000	924						
T1-2500	1500	1006	1000	900						
T2-2100	1197	835	800	819						
3-PC in										
T2-2100	1230				864	1000	840	857	1000	690
T1-1200	1140				903	1000	840	896	1000	870

The four rightmost bars show the average earnings in 3-person coalitions for all four values of the small coalition. It is obvious that earnings are significantly higher in 2-person coalitions in T1-2800 and T2-2500 than in all other cases. Of course, one could argue that only "fair" proposers choose the 3-person coalition implying a downward bias on proposer earnings in 3-person coalitions. We have therefore calculated the income maximizing offers on the basis of the logit regressions (4.1)-(4.3):

$$x^*_{Ri} = \arg\max_{x_{Ri}}(1 - x_{Ri})Accept(x_{Ri}), \tag{4.4}$$

gives the maximizing offer share in 2-person coalitions and

$$\{x^*_{R1}, x^*_{R2}\} = \arg\max_{(x_{R1}, x_{R2})}(1 - x_{R1} - x_{R2})AcceptR1(x_{R1})CondAccept(x_{R2}), \tag{4.5}$$

gives the maximizing relative offers to the first and the second responder in a 3-person coalition. The results recalculated to points are given in table 7. The table also shows average and modal offers across the last two rounds. $maxE\pi$ denotes the theoretical maximum of proposers expected money income using x^*_{Ri}, x^*_{R1}, and x^*_{R2} for 2- and 3-person coalitions, respectively, for the different values of the small coalition.

The values of $maxE\pi$ clearly show that given the responders' behavior the proposers expected money income is highest in 2-person coalitions in T1-2800 and T2-2500. These are also the two conditions where almost all proposers actually choose the small coalition. In T2-2100 proposers seem to be indifferent between the 2- and 3-person coalition (remember that under this condition we observe about 50 percent 2-person coalitions). In view of the expected maximum income in 2- and 3-person coalitions in this condition this is not surprising. The difference is only 33 points (USD 0.3 in money terms) implying that from the viewpoint of an income maximizing proposer one coalition decision is as good as the other.

Furthermore, in all cases (except the offer to the second responder in T2-2100) proposers make offers, which come surprisingly close to the optimal offer(s). In all conditions the average proposer only offers a bit too much. However, when comparing optimal with actual offers one should keep in mind that the values of $x^*_{R.}$ are based on the assumption of risk neutrality. If proposers are risk averse, the optimal offers are higher than those given by (4.4) and (4.5). Furthermore, an individual proposer has much less information about responders' behavior than an econometrician who estimates the probability of acceptance of a particular offer.

In our view the evidence in favor of hypothesis SI&NR is quite convincing. Responders behave in a negative reciprocal way in 2- as well as in 3-person coalitions. They punish unfair proposals by rejecting them. A majority of proposers anticipates this behavior and chooses the 2-person coalition whenever this leads to a higher expected income. We can therefore state our main conclusion:

Result 5 *Selfishness together with (anticipated) negative reciprocity lead to social exclusion and inefficient allocations.*

4.3 Inefficiency

Note that the inefficiency we are describing is not inefficiency due to the rejection of unfair offers. This kind of inefficiency can be overcome (or at least it can be reduced) when players gain experience, or when proposers know the responders' threshold value exactly. For the inefficient choices observed in our experiment this does not help. As long as negatively reciprocal behavior exists and when – given the threshold value of responders – the value of the small coalition is large enough compared to the value of the grand coalition a selfish proposer will always choose the inefficient allocation. A final look at the coalition decisions confirms this. The frequency of 2-person coalitions in T2-2500 is in all rounds as high as in T1-2800, although the efficiency loss under the latter condition is considerably higher than under the former. We ran a round by round comparison with the null hypothesis that the probability that a (randomly selected) subject in T2-2500 chooses the 2-person coalition is the same as the probability that a subject in T1-2800 will do that. The Fisher exact test shows that for no round the null hypothesis can be rejected (the p-value is never smaller than 0.168; 1-tailed). This shows that increasing the efficiency loss from 6.67 to 16.67 percent does not retain proposers from choosing the inefficient (and unfair) allocation. Furthermore, even if the value of the 2-person coalition is only 2100 points, still around half of the proposers choose the inefficient allocation thereby inducing an efficiency loss of 30 percent. For T2-2100 the binomial test does not reject the null hypothesis that in each round the probability of observing a 2-person coalition is equal to the probability of observing a 3-person coalition for every round. For T1-2800 as well as T2-2500 it has to be rejected. This also holds for each round ($\alpha = 0.05$, 1-tailed; in all three cases).

Figure 6 depicts the efficiency loss induced by the proposers' coalition decision for all four values of the 2-person coalition.

Figure 6:

For $V(P, Ri) = 2800$ the efficiency loss varies between 4.9% (rounds 1 and 2) and 6.1% (round 7), for $V(P, Ri) = 2500$ between 12.0% (round 4) and 14.8% (rounds 2, 3, 7, and 8), and for $V(P, Ri) = 2100$ between 13.3% (rounds 2, 3, 4, 6, and 8) and 20.0% (rounds 1 and 5). Over all rounds the induced inefficiencies are 5.5 percent for T1-2800, 14.0 percent for T2-2500, and 15.2 percent for T2-2100. In our view, none of these efficiency losses can be regarded as negligible. Our conclusion is that selfishness together with anticipated (and actual) negative reciprocity lead to economically significant inefficiencies.

5 Conclusions

In this paper we argue that motivations to punish unfair behavior lead to economically and socially undesirable consequences. Social exclusion and significant efficiency losses can be the result of human propensity to punish behavior considered as unfair. We have designed experiments where these consequences can be observed when negatively reciprocal forces are at work. In our experiments a proposer has the possibility to choose between a 3-person and a 2-person coalition. By choosing the small coalition the proposer opts for an inefficient allocation and excludes at the same time one potential bargaining partner. Choosing the 3-person coalition is always an efficient choice and gives the proposer the possibility to divide the surplus in a fair way between all bargaining partners. In both possible coalitions the chosen bargaining partner(s) have full veto power and can turn down the proposal made, leading to zero payoff for everybody.

The regularities observed in our experiment strongly suggest that the anticipation of negative reciprocity, i.e. the punishment of offers viewed as unfair, has a strong impact on the proposer's coalition decision. Proposers do not hesitate to exclude potential bargaining partners and to make inefficient choices. This behavior is very robust to variations in the efficiency loss incurred by choosing the small coalition. Increasing this loss from 6.67 to 16.67 percent does not affect the frequency of inefficient choices and social exclusion. Even if the efficiency loss is increased to 30 percent, half of the proposers choose the inefficient and unfair coalition. Unlike the inefficient outcomes observed in 2-person ultimatum games, which are due to rejections of unfair offers, the inefficient choices we observe in our experiment can not be overcome by experience or complete information about responders' threshold values. As long as the behavior of subjects is at least partly guided by negative reciprocal considerations neither social exclusion nor inefficient outcomes will vanish with experience and/or complete information, in an institutional set up similar to our experimental design.

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